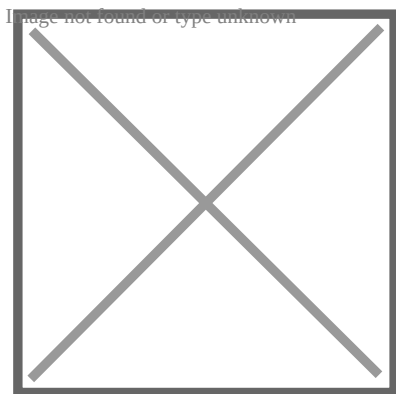




What's driving the UK weather this January?

Description

Weather headlines have been in demand in recent weeks, with a recent deep freeze in North America taking wind-chill temperatures as low as -48°C and much of Europe seeing in the new year with record-breaking mild weather for at least eight countries.

However, despite the noteworthy weather in recent weeks and days to the east and west of the UK, a more typical winter weather pattern is most likely in January, with a number of factors driving an unsettled outlook.

Recent cold in North America

Although the coldest conditions have now relented in North America, the temperature contrast had been helping to invigorate the jet stream, which is the driving force behind much of the UK's weather.

Met Office Deputy Chief Meteorologist Rebekah Sherwin said: "The temperature drop in North America before the end of 2022 was the underlying cause of our wet and windy weather in the run-up to New Year. The conditions across the Atlantic served to strengthen the jet stream and help send low pressure systems and weather fronts towards the UK, resulting in the recent unsettled conditions.

"Those incredibly low temperatures have now passed in North America and there will not be any direct impacts from that period of weather on the UK in terms of any potential snowfall events."



North America has seen some impactful snow and ice in recent weeks (Image: Shutterstock)

Mild Europe

Exceptionally high temperatures have started the year for much of Europe with Poland, Denmark, the Czech Republic and Belarus, among others, already having recorded their warmest January day on record.

In Brest, Belarus, temperatures would normally be around 0°C at this time of year but reached a balmy 15.9°C on New Year's Day, eclipsing its previous January record by a considerable margin.

The driving force behind this exceptional heat was a warm air mass from the west coast of Africa, which moved across Europe, bringing unseasonably warm conditions.

Rosie Oakes is a Climate Scientist at the Met Office. She said: "Although this specific event can't be attributed to climate change without a formal study, the increases in average global temperatures caused by human activities such as burning fossil fuels makes it more likely that temperature records will be broken.

"What's noteworthy about this event is how widespread it is as well as the amount previous records have been exceeded by. Climate models projects that both the frequency and intensity of these warm weather events will increase in the future, not just in the summer but in the winter too."



Brest, Belarus, eclipsed its January temperature record by a considerable margin (Image: Shutterstock)

Has this had an impact on the UK outlook?

The influence of the North American Christmas cold weather on the strength of the jet stream has now passed. However, other cold air outbreaks across North America and the Pacific, both recent and upcoming, are likely to affect North Atlantic jet streams in a similar fashion in the coming days. This means a continued wet and windy outlook for the UK, at least through the first part of January, with weather systems likely to impact the UK from the west.

Another underlying factor behind the UK long-range outlook is the ongoing [La Nina](#) event, which sees episodes of cooler than average sea surface temperature in the equatorial Pacific. This can often lead to a drier and cooler first half of winter, before a transition to more unsettled conditions in January and February, with frequent wind and rain moving into the UK from the west.

Rebekah Sherwin added: "A westerly regime is most likely for the UK in the first part of January, which means wet and windy conditions for many. Rain or showers will often be heaviest and most frequent in the west and northwest but areas further south and east are by no means immune. Temperatures are expected to be near or above average overall, with any sleet or snow most likely restricted to high ground in the north.

"Towards the middle of the month there are some indications that the jet stream will weaken, which may be related to current and upcoming patterns of thunderstorm activity in the tropics. This may well

lead to less unsettled conditions developing for a time, with an increased chance of colder, drier spells for many parts of the UK, although there aren't currently any significant signs of long-lasting cold weather."

Keep up to date with the latest forecast on our [website](#), by following us on [Twitter](#) and [Facebook](#), as well as on our [mobile app](#) which is available for iPhone from the [App store](#) and for Android from the [Google Play store](#). Keep track of current weather warnings on the [weather warning page](#).

Date Created

January 2023

Climate change and health

Description

Climate change affects our daily lives. The climate influences the type of food we grow and eat; water availability; the way we cool our homes; and deciding where to build new accommodation for a growing and moving population. Cross-cutting all of these themes, linking climate change with food, water, sanitation, shelter and migration, is health. Ahead of the UN's Climate Conference, COP27, in November 2022, [WHO highlighted the need for urgent climate change action for health](#).

Climate-related health risks

Professor Dann Mitchell, Professor of climate science at the University of Bristol, explains that “Weather and climate are already impacting health; even as far back as the infamous 2003 European heatwave we know that around half the deaths could have been avoided if climate change had been halted.

“To fully understand the health impact of climate change, we must consider the exposure across short- and long-time scales. At one end of the spectrum daily extreme temperatures act immediately on the cardiovascular system, at the other end, decades or persistent warm nights act on the cognitive system”.

Risks from a changing climate include an increase in heat-related illness, respiratory illness, mental health problems and vector-borne diseases, such as dengue or malaria. Whether a disease is passed through the air, water or carried by insects, the impacts of climate and extreme weather increase the risk.

As with other climate-related risks, the most vulnerable in society are likely to be the most impacted, whether that be people with underlying health conditions or those living in developing countries where climate impacts might be greater and/or healthcare provision may be less advanced.



Image: Shutterstock

Mitigate and adapt

Whilst we are already seeing the effects of our changing climate, there is still time to mitigate against the worst impacts by rapidly reducing carbon emissions. This also has additional co-benefits such as reduced air pollution which is a serious public health problem. The University of Leeds, working with the Met Office, [developed a new tool](#) for policymakers, academics and industry to see how single actions can have multiple benefits for people's lives, including on health.

Adapting to the changes we are already seeing and will see in future, will also make society and individuals more resilient to the health impacts of climate change. This can include making sure people are aware of immediate risks, such as through severe weather warnings – [the Met Office introduced a new severe weather warning for heat in 2021](#), reflecting the fact that the UK can expect more extreme heat as a result of climate change. Adapting homes and buildings as well as healthcare provision will also be vital to tackle climate change impacts.

During January, we will be exploring the theme of climate change and health, looking at some of the ways our health could be impacted and sharing research from the Met Office and our partners to better understand the risks and tackle the issues. Follow #GetClimateReady on Twitter to find out more.

Date Created

January 2023

Heat in cities – the health impacts of a changing climate

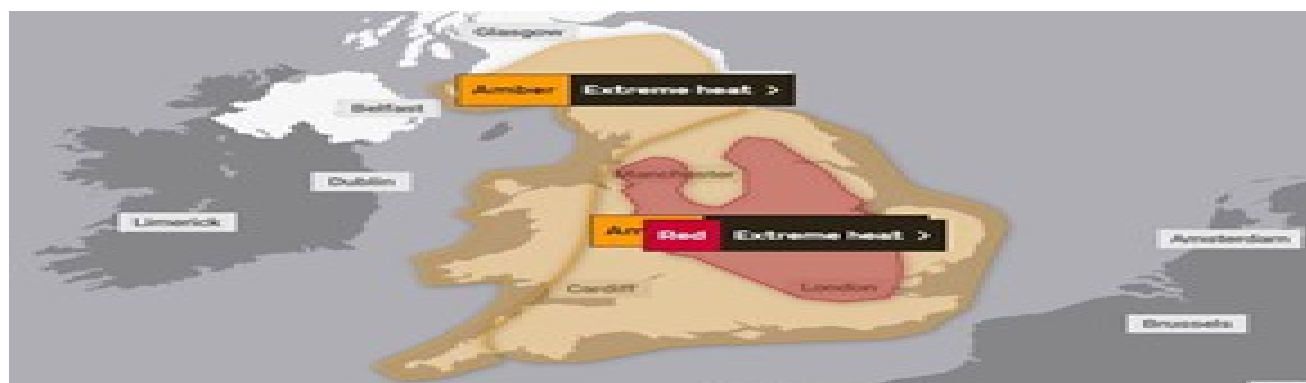
Description

Health is already impacted by the weather, with heat in particular causing heat-related illnesses, exacerbating existing health conditions and excess deaths. In a changing climate, these impacts can be expected to increase. Urban areas are particularly vulnerable to changes in heat and as more people move into urbanised areas, it is important to understand how extreme heat will affect health and how these impacts can be minimised.

Extreme heat

Last year, the UK experienced an unprecedented heatwave in July, where temperatures exceeded 40°C for the first time. This was a milestone in UK climate history, which was complemented by the first ever red severe weather warning for heat issued by the Met Office. Some areas of southern England recorded their highest ever temperatures by extraordinary margins of 3-4°C.

A Met Office study has recently been supported by the [World Weather Attribution](#), which found that the likelihood of seeing 40°C in the UK has been 'rapidly increasing' and what once would have been an extremely unlikely event without climate change, has now become an unmistakable possibility. Both studies found that human induced climate change has made the chance of 40°C in the UK about 10 times more likely when compared with pre-industrial levels.

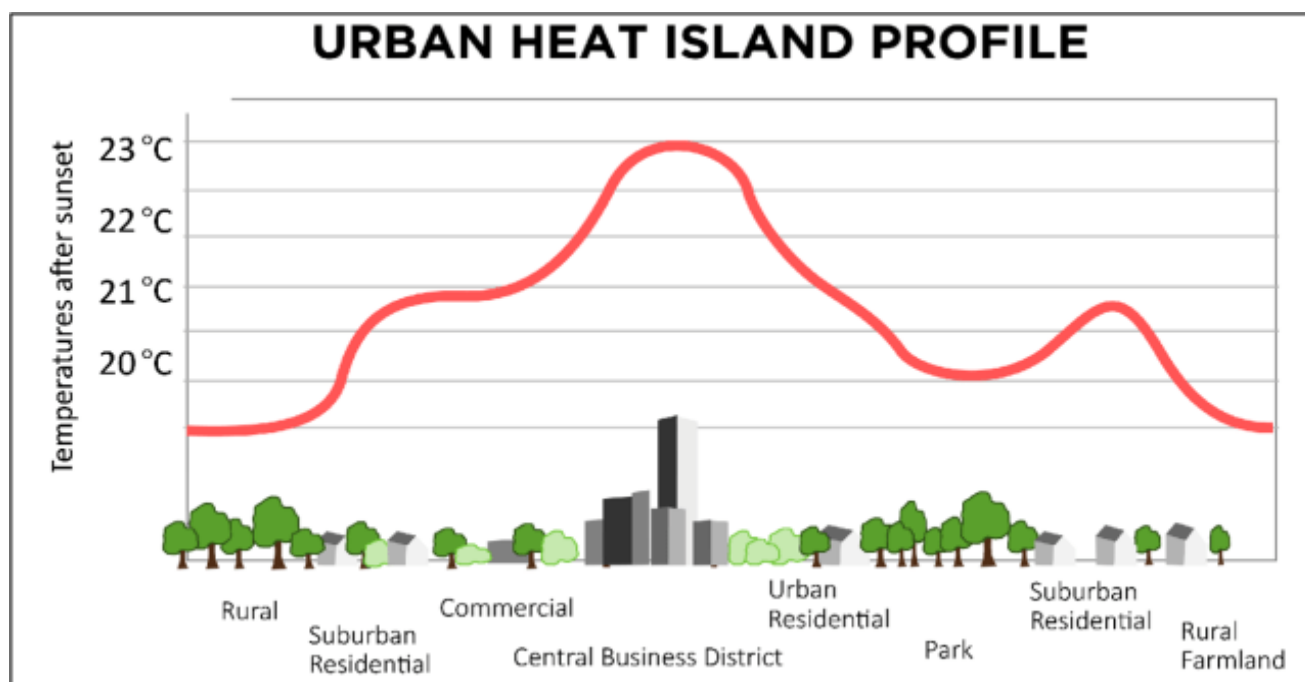


According to an analysis by the Office of National Statistics, from 10-25 July 2022, spanning the dates encompassing the new record temperature was hit, excess deaths were 10.4% above average for that period. This short-term increase in mortality is common during heatwaves. For example, the 2003 heatwave accounted for over 2,000 excess deaths in the UK: and in 2019 a heatwave which caused temperatures in England to reach 38.7°C caused 892 deaths. Direct increases in mortality and morbidity are usually amongst the most vulnerable groups which include people aged 75 years and over, infants and those with chronic medical conditions. These effects can be expected to increase especially among the elderly as the demography of the population shifts to include an increasing proportion of old-age citizens. High temperatures can also lead to an increase in heat-related illnesses such as heat stroke and heat exhaustion. Symptoms include nausea, dizziness, muscle weakness and

high body temperature.

Urban heat island effect

Living in a city can increase vulnerability to heat. Many deaths during heatwaves occur because of the combined effect of high temperatures and the urban micro-climate. In addition to background warming an additional factor facing city residents is the urban heat island effect. Buildings absorb rather than reflect the sun's heat, and waste heat from air conditioners and vehicles can add warmth to the surroundings, increasing temperatures. Additionally, tall buildings and narrow streets reduce wind speeds, and the removal of trees reduces the natural cooling effect of shading and evaporation. Air pollution can also cause the effect of a micro greenhouse gas layer, stopping heat from radiating back into the atmosphere.



As more people move to urban areas in the UK, more people will become vulnerable to changes in climate and extreme weather events. Heat risks in urbanised areas can be minimised by utilising the amount of green space available, for example by planting trees in open spaces and in the streets. Heat reduction policies and rules could also be put into place at a local level.

Raising awareness

It is also important that local communities are educated about the risks associated with heat. Four in ten adults in England think heatwaves are “a normal part of summer”¹ and have positive views about hot weather. Most people do not see heatwaves as a threat so are less likely to take protective measures. Additionally, most people in England do not consider themselves as at risk from the heat, even those from high-risk groups including elderly adults aged 75 and over. If the impacts of heatwaves that are posed by climate change are not clear, people are more likely to be exposed to the risks. It is important that people understand the real dangers of extreme heat and prepare for this, particularly as the climate changes and these events become more frequent, intense and of longer duration.

Utilising climate information for adaptation

Cities therefore need to be informed by the latest climate research and observational data to increase their ability to adapt to climate change and minimise these risks. At the Met Office, our Urban Climate Services team have created Heat Packs which consist of fact sheets containing information about how extreme heat events may change this century due to climate change. The Heat Packs have currently been generated for Bristol, [Belfast](#) and Hull. This work has also been combined with socio-economic data to understand which areas are more vulnerable to heat risks within the city. These Heat Packs can be used to understand the risks of heat in particular cities so that these areas can be better prepared against extreme events as we make our way into an uncertain future. This is supported by the Climate Programme Manager from Belfast City Council who said, “The Belfast Heat Pack is an important resource for Belfast and is being used to support both city and council climate planning and the development and delivery of climate projects such as the UPSURGE project and Belfast One Million Trees Project. We need to understand the impacts of heat on the city and on our residents as we plan for future climate changes and the Heat Pack is extremely helpful in supporting that”.

1. British Red Cross, (2021). ‘Feeling the heat: a British Red Cross briefing on heatwaves in the UK’. [online] Available at: [Feeling the heat: a British Red Cross briefing on heatwaves in the UK | British Red Cross](#)

Date Created

January 2023

Changing climate brings impacts for hay fever sufferers

Description



For this month's climate theme, we are focusing on health. In this blog post, we're discussing pollen, the impacts that it can cause for hay fever sufferers, and whether a changing climate will influence pollen levels throughout the year.

Pollen and hay fever

Respiratory allergies are more common than ever, and recent studies in Europe have found that some pollen types are increasing in severity, season duration and seeing an earlier onset as a result of climate change.

Pollen is made up of tiny particles which are released by plants and trees as part of their reproductive cycle. When inhaled, pollen can cause significant irritation and inflammation in people or animals who are allergic to it.

Hay fever symptoms usually appear when the pollen count reaches moderate or high, depending on the individual's sensitivity to the pollen allergens. 11% of UK adults suffer from severe hay fever and common symptoms include sneezing, runny or blocked nose, and itchy eyes, mouth and throat.

How weather and the seasons affect pollen levels

Rain, wind, temperature and sunshine all affect how much pollen will be produced and how much it will be dispersed. On warm, dry days with gentle to moderate winds, pollen spreads easily but on rainy days, pollen can be cleared from the air. On sunny days, the pollen count is highest in the early evening which is therefore when you are most likely to suffer from hay fever symptoms.

Seasonality and pollen

As well as the weather at the time of pollen dispersal, there are seasonal weather patterns that change things. We know that, on a daily basis, any rainfall decreases pollen, but a warm spring with sufficient rain will allow for good pollen production in grasses and the potential then for high summer pollen counts.

Conversely, very dry weather in spring suppresses pollen production in grasses, reducing the potential, and very hot and dry weather actually prevents grasses from growing at all. For tree pollen, the production occurs in the catkins in the previous summer and if June and July are very warm, then there will be more pollen produced. This is happening more frequently due to climate change increasing the summer temperatures.



The influence of climate change on UK seasons

The UK has a temperate maritime climate which means that we generally have a cool and mild climate

with changeable weather. As a result of climate change however, we can expect to see some changes to the weather we see in the UK. In the future, whilst we will still see a lot of the same weather that we experience today, the intensity of some weather types will change. Across the UK, we are already seeing and expect that we will continue to experience:

- Warmer and wetter winters
- Hotter and drier summers
- More frequent and intense weather extremes

Research to explore the climate change/pollen link

A recently conducted study looked at pollen trends in the UK over the last 26 years to better understand the relationship between these trends and meteorological factors. Led by the University of Worcester, the study examined a range of UK pollen sites, with a focus on the key pollen types: grass, birch and oak.

The results of the study revealed a somewhat mixed picture of how different types of pollen are affected by climate change. One of the key findings was the fact that oak and grass pollen seasons are starting earlier, and the birch season is getting more severe. The study also highlighted how increasingly unusual weather – as a result of climate change – coincided with increasingly erratic pollen seasons. It was also noted that a trend to lower wind levels is reducing dispersal of grass pollen grains in the summer.

Dr Beverley Adams-Groom, senior pollen forecaster at the University of Worcester and lead author of the study, said: “Climate change is impacting on seasons. It’s difficult to predict the long-term future as there are many factors at play. What we do know is that there are going to be more extreme weather events – that’s documented, and that can impact on the seasons.”

The future? More pollen unpredictability

Whilst the study findings may not indicate a drastic influence from climate change in terms of increasing pollen levels, what is clear is that if the current climate trajectory remains the same, the trends that have been identified are expected to continue.

Climate change will very likely cause increasingly erratic and unpredictable seasons and weather patterns. The biggest defence for hay fever sufferers is to be prepared, something which these changes caused by climate change will make more difficult.

We are already seeing the impacts of climate change, including on pollen, and change will continue to occur. We can still [mitigate](#) against the worst impacts, however, by rapidly reducing emissions.

In addition to our daily weather forecasting services, we provide pollen forecasts for five days ahead across the whole of the UK during the pollen season. These forecasts are produced by combining data from the [pollen count monitoring network](#) with Met Office weather data and expertise from organisations such as the National Pollen and Aerobiological Unit. You can learn more about our pollen forecasts and find advice on preparing for and managing the symptoms of hay fever on [our website](#).

Date Created

January 2023

The temperate rainforests of Dartmoor

Description

Last week, Dr Debbie Hemming, Scientific Manager of the Met Office Vegetation-Climate Interactions (VCI) group, took part in filming and podcast recording for the [Sky Climate Show](#) on the subject of temperate rainforests. Here, Debbie explains why she is so interested in temperate rainforests and why they are an area of scientific research.

It might sound strange, but contrary to belief we do have rainforests here in the UK. Indeed, you don't have to travel far from our Exeter HQ to find them. Nestled in isolated pockets along the moisture-laden west coasts of the UK and Ireland are fragments of lush ancient woodland that belong to the ecological group known as Coastal Temperate Rainforest.

Although these habitats occur in other locations around the world, they are limited to small, isolated pockets and are therefore considered rare and threatened by changes in climate, land use and associated impacts, such as wildfires or pests and diseases.

I was recently approached by Tom Heap from the Sky Climate Show who was interested to learn more about these fascinating ecosystems, why they are important and how they might be at risk from climate change.

We met at a spot almost right in the middle of Dartmoor on a suitably wet and windy morning and walked a short distance to find one of these magical locations.



Dr Debbie Hemming being interviewed by Tom Heap for the Sky Climate Show. Image: Met Office

Temperate rainforests are fascinating, diverse ecosystems. In the UK, they occur in isolated areas with at least 1,500mm of rainfall each year, although in Scotland this can be over 4,000 mm per year which is more than in many tropical rainforests. The ecosystems are characterised by oak trees, often stunted and contorted by the extreme conditions, interspersed with hazel, birch, rowan, ash and holly trees.

Covering everything in sight are vibrant green mosses and diverse lichen, which further support a community of ferns and other epiphytes. Various species of small animals, birds and insects are attracted to the benefits that these habitats provide. The abundance of mosses and lichen also indicate a requirement for clean air.

As well as being a landscape that can benefit wellbeing, temperate rainforest ecosystems provide us other services. By supporting flora and fauna that wouldn't otherwise survive in these areas they increase the biodiversity of the region and provide a carbon sink that would not otherwise exist. They also play a role in flood control by slowing the transport of intense rainfall to the rivers.

However, with our changing climate and continued pressure on land use, the risks to temperate rainforests are likely to increase. We expect to see more weather and climate extremes as a consequence of our warming climate. Further hot, dry spells could threaten these habitats as they rely

on high levels of rainfall and humidity to function. Increases in wildfires could also pose a risk to the small patches of land occupied by temperate rainforests.

It's therefore important for scientists to understand the changes that climate extremes and trends are likely to have on temperate rainforests, and indeed other habitats around the world, in order to provide scientific advice to support their sustainable management into the future.

Date Created

January 2023

Staying on track in summer heat and winter chills

Description

The weather impacting travel plans isn't anything new. But for the UK's railways, our varied and changing climate introduces additional challenges.

A changing climate increases the frequency of severe weather events. Warmer air can hold more water, so [rainfall is increasing on average across the world](#). In some places, rainfall is becoming more intense as well.

In addition, record-high temperatures are being seen more frequently. Summer 2022 saw the [UK record breaking a new all-time high of 40.3°C](#) during a heatwave when 46 stations met or exceeded the previous national record of 38.7°C. With records highs, railways in the UK also have to endure sub-zero conditions in the winter, and even high-impact storms.



Image: Shutterstock

During Storm Eunice in February 2022 – which struck during a week of three named storms – cancellations on the rail network was at 44.1%.

[The Office of Rail and Road \(ORR\)](#) is the independent regulator responsible for safety monitoring on Britain's railways; an area of the UK's travel infrastructure that can be sensitive to variations in the

weather.

ORR's role for Britain's railways involves working with train operators to ensure safety procedures are being followed and that people can get around safely on Britain's trains, whatever the weather.

Paul Appleton is Deputy Director of Railway Safety at ORR and his team is busy working with operators through the winter season. He said: "Temperature range is a very interesting issue when it comes to the ability of Britain's railways to run safely.

"At the cold end of the spectrum, the steel on our railways contracts, which can put them under massive tension and expose any underlying flaws. When it gets hotter, the steel expands and if it gets to extreme levels of heat then that expanding rail will risk buckling and possibly derailing a train."

In 2022 temperature extremes weren't hard to come by. The record maximum temperature of 40.3°C was recorded at Coningsby in July as part of a severe and widespread heatwave. At the other end of the scale, -17.3°C was the lowest temperature recorded in 2022, in Aberdeenshire in December. Train operators are often forced to impose speed restrictions to mitigate risks at either end of the spectrum.

Part of ORR's remit is to ensure train operators have the processes in place to manage variations in temperature; something that can be traced back to selecting the type of steel used for Britain's railways.

Paul said: "Rail temperature is very different to air temperature and there's an operable range for steel railways. You can design your steel to work within a certain range, but you can't extend that range. If you want the railways to be able to withstand 40°C summer heat, you'll lose some of its reliability in lower temperatures during the cold winter months."

Winter weather

As cold winter weather has come back into force in recent days, ORR's focus has shifted towards low temperatures, snow, ice and the possibility of named storms.

"With snow, the problem is pretty obvious. If there is enough of it, it blocks the railway. With ice, there's a risk of it forming on the 3rd rail which can prevent trains from drawing sufficient power," said Paul.



Image: Shutterstock

Fortunately, rail operators, much like the public at large, take preventative action to mitigate the impacts of severe weather.

In the early hours of the morning, while much of the country is still sleeping, trains take to tracks all over the country clearing leaves from the line and de-icing the surface of the 3rd rail.

“Leaves on the line can be a big issue at this time of year. When trains run over leaves on a track, it creates a poor adhesion environment, where trains – which are obviously very heavy – struggle to get the friction required to move and stop efficiently.

“Just one way that risk is managed is with trains being sent out with high pressure jet washers to keep leaves off the line and ensure trains have the best possible contact with the track. This will often also include applying a substance to improve grip.”

According to Rail and Standards Board figures, poor adhesion costs the rail industry and wider society an estimated £355million every autumn. The Met Office works with many leaf adhesion services to [help improve efficiencies throughout the year](#).

Be prepared



Tracks have an operable temperature range which can be sensitive in a UK climate.
(Image: Shutterstock)

With steps taken to prepare railways ahead of severe weather, the public also have a role to play in keeping Britain's railways running smoothly.

For ORR, a 'severely disrupted day' of rail travel is when cancellations are at 5% or more. During Storm Eunice on 18 February, that rate was at 44.1%.

Paul says the preparedness of the public for severe weather can help mitigate the disruption on days of severe weather.

"After a storm, debris on the line is one of the leading causes of ongoing disruption to rail services. Of course, some of this is down to fallen trees, but we also get a lot of garden furniture and trampolines on the tracks which all has to be dealt with before services can fully resume.

"Taking some time ahead of a storm to check for things that could be blown away would help and could also prevent delays on roads as well.

"If you're looking to travel after a storm, take some time to check your train operator's website to see if there are likely to be any issues. It's thanks to the Met Office that they know when weather conditions will be impactful enough to disrupt operations, so do also check the Met Office website or App ahead of travel."

The Met Office's [WeatherReady](#) website brings together seasonal advice from expert partners to help you stay safe and make the most of the weather all year round. WeatherReady provides [simple](#)

preparedness tips anyone can do to help them prepare ahead of severe weather.

Date Created

January 2023

An awe-inspiring visit to AmazonFACE

Description

A landmark experiment is taking place in the Amazon Rainforest. Misha Khan from the Met Office International team explains what AmazonFACE is; why it's so important and what it was like to visit the experiment site.

At the beginning of December, I had the opportunity to visit the [AmazonFACE](#) site in Manaus, Brazil. This current phase of the project is a partnership between leading climate scientists and organisations in Brazil from the [National Institute for Amazon Research](#) (INPA) and [Unicamp University](#) alongside scientists from the Met Office.

The project also collaborates with [The Birmingham Institute of Forest Research](#) (BIFoR), Exeter University and other world-leading consultants, and is funded by the UK's Foreign, Commonwealth & Development Office (FCDO). More recently the Brazilian Government have provided a long-term funding commitment to the project.

About AmazonFACE

AmazonFACE is a real-world climate experiment to build understanding of the Amazon rainforest's response to environmental change. FACE – 'Free- Air CO₂ Enrichment' – is an existing experimental method where controlled volumes of carbon-dioxide (CO₂) are pumped into small areas of forests, crops or other ecosystems to simulate their response to climate change.

Taking place in different parts of the world including the UK and Australia, FACE has, until now, never been done at scale within a tropical forest environment, which is no doubt a huge undertaking. Scientists and experts are keen to experiment with FACE in Brazil as it is crucial to understand the Amazon rainforest's response to climate change. The experiment seeks to develop understanding of lesser-known areas of climate science such as '*how will the world's largest tropical rainforest interact in the future with increased carbon-dioxide emissions in warmer, drier conditions?*'

An awe-inspiring experience

I recently got the opportunity to visit the experiment site. During my week in Manaus, I met the team leading the project from INPA and Unicamp. The scientists have backgrounds in ecosystems, biogeochemistry and meteorology and shared their dreams from over ten years ago of building AmazonFACE. To finally see this come to fruition is inspiring.



With the AmazonFACE team at the INPA office, Manaus. Image: Met Office

The site can be found approximately 70 kilometres from Manaus, the capital of the state of Amazonas. The journey was smooth and straightforward, but I was told that this wasn't the case up until a few weeks ago as the road turning to the site off the motorway was rather rocky and steep, adding an additional 50 minutes to the journey and slowing progress due to difficult access.

Thanks to funding for the project, the road has improved greatly – reducing arrival time to the site and improving health and safety. It will of course be crucial to ensure that the upgraded road does not encourage others to enter this area of forest and risk leading to deforestation.

As I stepped out of the car and into the Amazon rainforest, it felt as surreal as one can imagine. Feeling cool (in 33°C?!) as I was shaded under huge trees towering over me; observing beautiful species of fruits and plants I had never seen before; and hearing the sounds of animals and birds echoing through the forest!

It was only when I visited the site for AmazonFACE that I truly understood the immensity of the project and appreciated the effort it has taken. Huge concrete blocks carefully built to protect the forest floor and canopy surround a group of trees (those that will be observed) and in the centre of the ring is a 30-metre tower to aid scientists and researchers with their observations of the plants and trees within the parameters of the ring.

This forms one of the six rings of the FACE experiment and it is anticipated that all six rings will be in operation by the beginning of 2024. The installation process was taken with great care to minimise damage to the forest, with the towers being positioned with precision to avoid the removal of trees wherever possible.



At the top of the 30-metre tower, above the canopy of the Amazon Rainforest. Image: Met Office



Project Oversight Group (POG) members including Dr Tomas Domingues, Professor Beto Quesada, Professor David Lapola, Dr Bruno Tanaka, Dr Sabrina Garcia, Dr Richard Norby and Professor Richard Betts at the inauguration of the AmazonFACE site. Behind them is the first site with six tower foundations and two towers that will soon form one completed ring. Image: Met Office

The launch event

The INPA AmazonFACE launch event and site inauguration then followed. These were well attended by key funders and supporters of the project – Secretary Marcelo Morales, Ministry of Science, Technology and Innovation (MCTI), Melanie Hopkins (Deputy Ambassador to the UK, FCDO), Richard

Ridout (UK Prosperity Counsellor) and Professor Richard Betts MBE (Met Office). Dr Richard Norby, Honorary Professor at the University of Birmingham, was also in attendance – Richard is recognised as the main authority in FACE systems in the world.

During the press interviews and speeches, Professor Richard Betts shared encouraging words, *“AmazonFACE’s pioneering work will provide crucial new understanding of forest processes, which will help us to further improve Earth system models to provide improved estimates of the carbon balance to keep global warming well below 2°C.”*

The overall tone of the two-day event was very positive. Senior attendees shared their excitement at seeing this phase of the project come to life, filling the AmazonFACE project team and scientists with happiness and pride which came through in their emotional speeches.



Senior representatives from MCTI, FCDO and INPA attended the launch event. Image: FCDO

Next steps

All collaborators are committed to working in partnership to complete the infrastructure build for the first pair of rings and control the level of CO₂ in the canopy, plot the remaining four ring locations in the forest, and complete the site groundwork ready for another sixty-four, thirty-five-metre-tall towers and four tower cranes.

Whilst the remaining work is undertaken to complete the AmazonFACE site infrastructure, which is a pioneering experiment on its own, the scientific community are already planning the requirements to start the experimental research phase of the project, which will generate significant data helping to explore the answers to their questions.

I feel privileged to have visited the site and see it come to fruition and I would like to thank the wonderful AmazonFACE team and FCDO Brazil for their hospitality and time. I look forward to learning more about the project in the future!

Date Created

January 2023

How does humidity affect health?

Description

Not so long ago, we might have looked forward to a heatwave, particularly here in the UK – a chance to enjoy the sunshine and balmy evenings. Heatwaves, however, can cause a range of health problems. If you cannot find somewhere cool or off-load the excess heat from your body it can be very serious indeed and the extreme heat seen in recent years, such as the [July 2022 heatwave](#), has resulted in a [significant number of excess deaths](#).

Keeping cool is particularly problematic when the heat is 'humid'. This is when the air contains lots of water vapour. High humidity makes it very hard for sweat to evaporate from our bodies which means that we cannot cool down. For people working outside or in overheating buildings, especially where the work is physically demanding, humid heat is a big problem. The world is getting warmer, and many places are also seeing increases in water vapour and the resulting humidity.

Researching exposure to high humidity and dry heat events

The distinction between humid heat and dry heat is a relatively new area of research. What we do know is that dry heat events can be much 'hotter' than humid heat events, and at present appear to be more lethal, or at least high temperature shows a stronger relationship with mortality than high humidity. However, humidity plays an important role in health and 'productivity'. People 'feel' worse when the humidity is high and cannot maintain physical activity at the same level. This could mean slower progress in construction, lower yields for manual food harvesting or fewer completed tasks within a factory, which have economic as well as health impacts.

Climate change and heat health is the focus of some of the research being undertaken by the [Weather and Climate Science for Services Partnership \(WCSSP\) programme](#), supported by the UK Government's Newton Fund. A CSSP China project has been developing a global dataset of extreme [wet bulb temperature](#) (T_{wb}) and air temperature (T) – HadISDH.extremes – that enables us to study the current level of exposure of regions to both high humidity heat events and dry heat events and measure the rate at which such events have increased in severity and frequency over the last 50 years. Wet bulb temperature is a common way of measuring humidity, is less complex than other measures of heat, and provides a critical threshold of 35°C beyond which the human body cannot survive for long. This is because human skin temperature is around 35°C. If the wet bulb temperature and skin temperature are both 35°C, sweating no longer works because the air next to the skin cannot hold any additional water and the body cannot cool down. In reality, even physically fit people struggle to undertake normal light activity when the wet bulb temperature gets within a few degrees of this threshold.

The HadISDH.extremes dataset allows us to identify those regions already experiencing very high wet bulb temperatures. Figure 1 shows that 31°C has already been reached several times over much of the tropics. This new dataset also allows us to investigate the two different types of events explicitly and explore what might be termed 'stealth heat events' where the air temperature might not be

excessively high, but the wet bulb temperature is high enough to affect health and productivity.

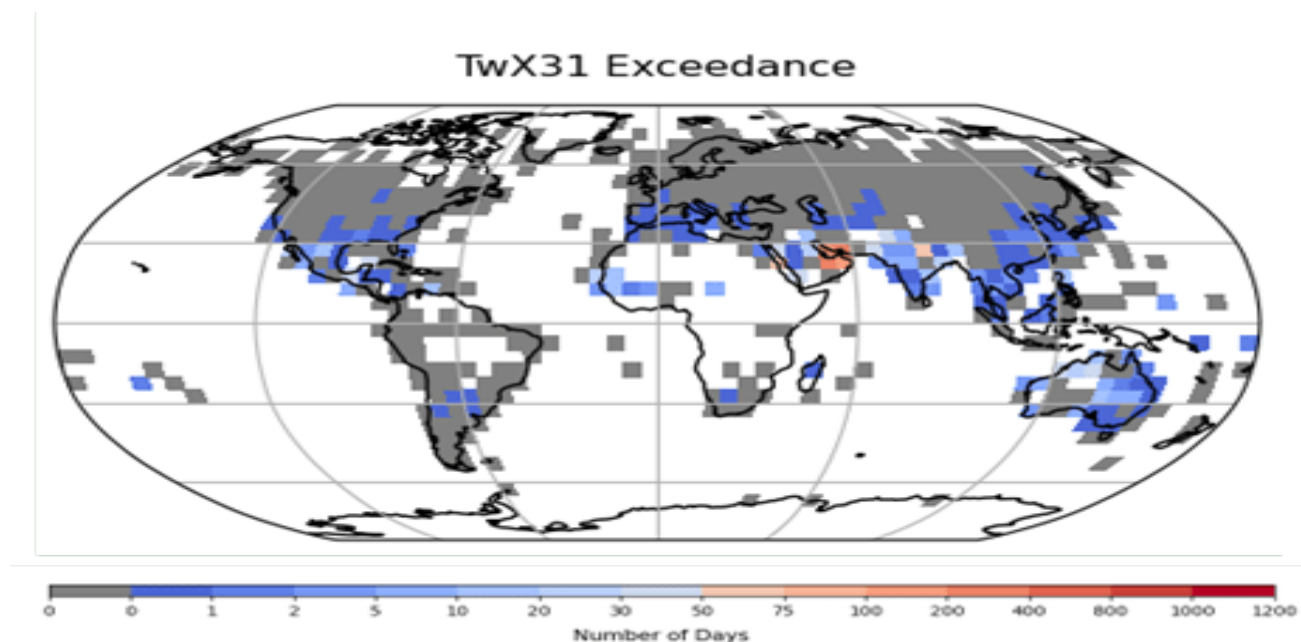


Figure 1.. Counts of days where the daily maximum T_w was equal to or higher than 31°C – January 2002 to December 2021.

Further global research

Other WCSSP programme research is also focused on heat health including:

- Researching which weather patterns bring humid heat over China, a region where high humidity heat is commonplace already because the hottest season also tends to be the wettest. Climate change will make this worse;
- Producing a global gridded dataset of 'sector specific' indices related to temperature such as 'Heating Degree Days', a 'Warm Spell Duration Index' and 'Excess Heat Factor';
- Using satellite Land Surface Temperature to produce [an interactive high resolution gridded dataset of temperature indices and urban hot spots](#);
- Quantifying the current and future population exposed to high heat over Brazil, for present day and for a range of potential futures depending on future greenhouse gas emissions. [This data has also been used globally](#);
- Exploring the predictability of heatwaves and their corresponding impact on population relating to weather patterns over South Africa;
- Investigating levels of solar and infrared radiation on people from surrounding building layout and fabric, which can significantly affect the heat impact in warm weather; and
- Assessing the contribution of human-induced climate change to heatwaves and specific heat events, including how much more likely they become.

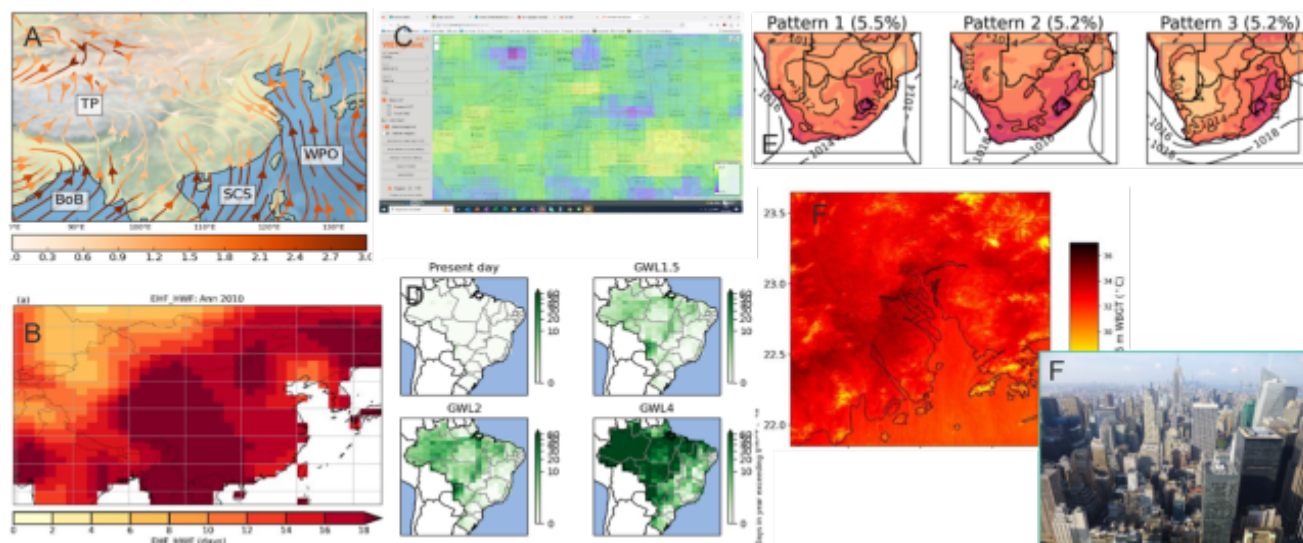


Figure 2. A compilation of research on climate and heat from the WCSSP programme. A) Weather patterns over China bring moisture from the sea. B) Excess Heat Factor (in days) over China for 2010. C) Satellite image of Land Surface Temperature over Beijing. D) Frequency in days of exceedances of “moderate” threshold heat over Brazil. E) Surface pressure pattern (circulation pattern) and temperature contours over southern Africa. F) Image of evening WBGT (wet bulb globe temperature) heat index over Shenzhen, China and a built-up urban area.

As our climate continues to change, research into health impacts will be critical to enable appropriate adaptation measures to be put in place. And by reducing emissions, we can minimise the worst impacts of climate change.

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January 2023

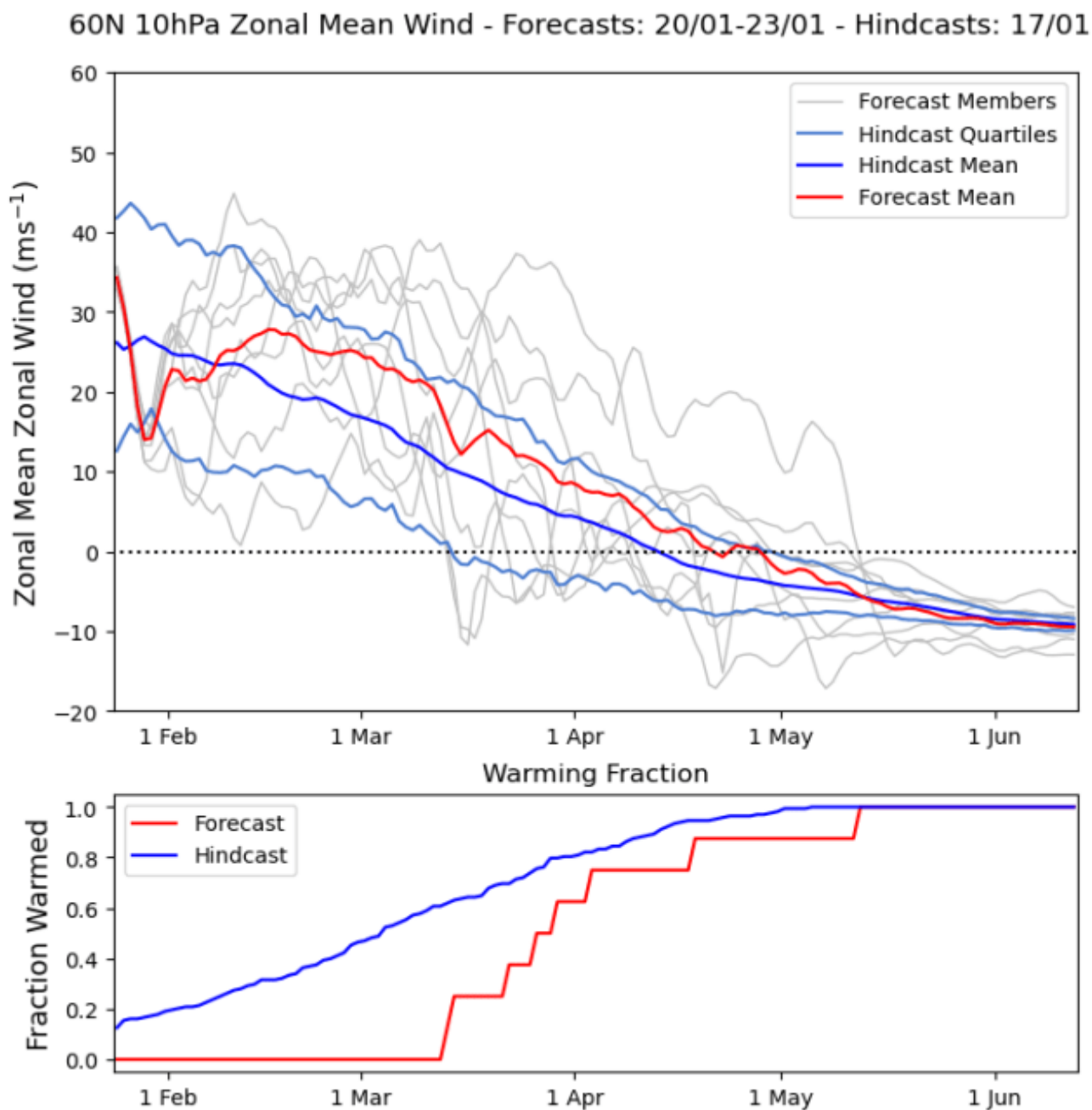
Has there been a Sudden Stratospheric Warming – and what does that mean for our weather?

Description

You may have heard speculation about a Sudden Stratospheric Warming (SSW) and that a 'Beast from the East' is on the way with freezing conditions and widespread snow.

Is there any truth behind the headlines and what can we say about the weather for the coming month?

Well, a [sudden stratospheric warming](#) is underway, but only a minor one. The warming is expected to peak towards the end of January. The strong westerly winds high over the Arctic, called the [stratospheric polar vortex](#), have weakened and the vortex is partially collapsing. However, the polar vortex has been unusually strong so far this year and although there has been a minor SSW, the winds are expected to rebound quickly, recovering to speeds around normal for the time of year.



It can take a week or more for any impacts from an SSW to work its way down through the atmosphere and to have any influence on the weather in the UK. However, not all SSWs lead to cold weather and widespread snow for the UK, for example, the SSW in February 2018 led to the '[beast from the east](#)' whereas the SSW in January 2019 had no significant impact for the UK weather, in fact, it stayed mild for the rest of the winter.

Forecasts at present show only minor impacts are expected and that other factors, such as [La Nina](#) and the [Madden Julian Oscillation](#) are also likely to influence our weather over the next few weeks. Our predominant weather is expected to come from the west with wet and windy periods. The unsettled conditions are expected to impact the north and west of the UK at the start of February as frontal systems push south across the country, weakening as they go with parts of the south remaining largely

dry. Temperatures will stay around average for many.

Changeable weather is likely to continue through to the second half of the month bringing rainfall, heavy at times, again to the north and west. The south and east are expected to see some drier and brighter periods with some lighter rain. A brief spell of more settled conditions is possible in the middle of the period, bringing a greater risk of overnight frost and freezing fog, especially under clear skies with light winds. Temperatures are expected to be generally at or slightly above average, although a brief colder spell remains possible.

The Met Office will continue to monitor the situation and, as ever, keep up to date on our [forecast pages](#) and [warnings](#) pages and by following us on [Twitter](#) and [Facebook](#). Our app is available for iPhone from the [App store](#) and for Android from the [Google Play store](#).

Date Created

January 2023

How do climate change, air quality and our health interact?

Description

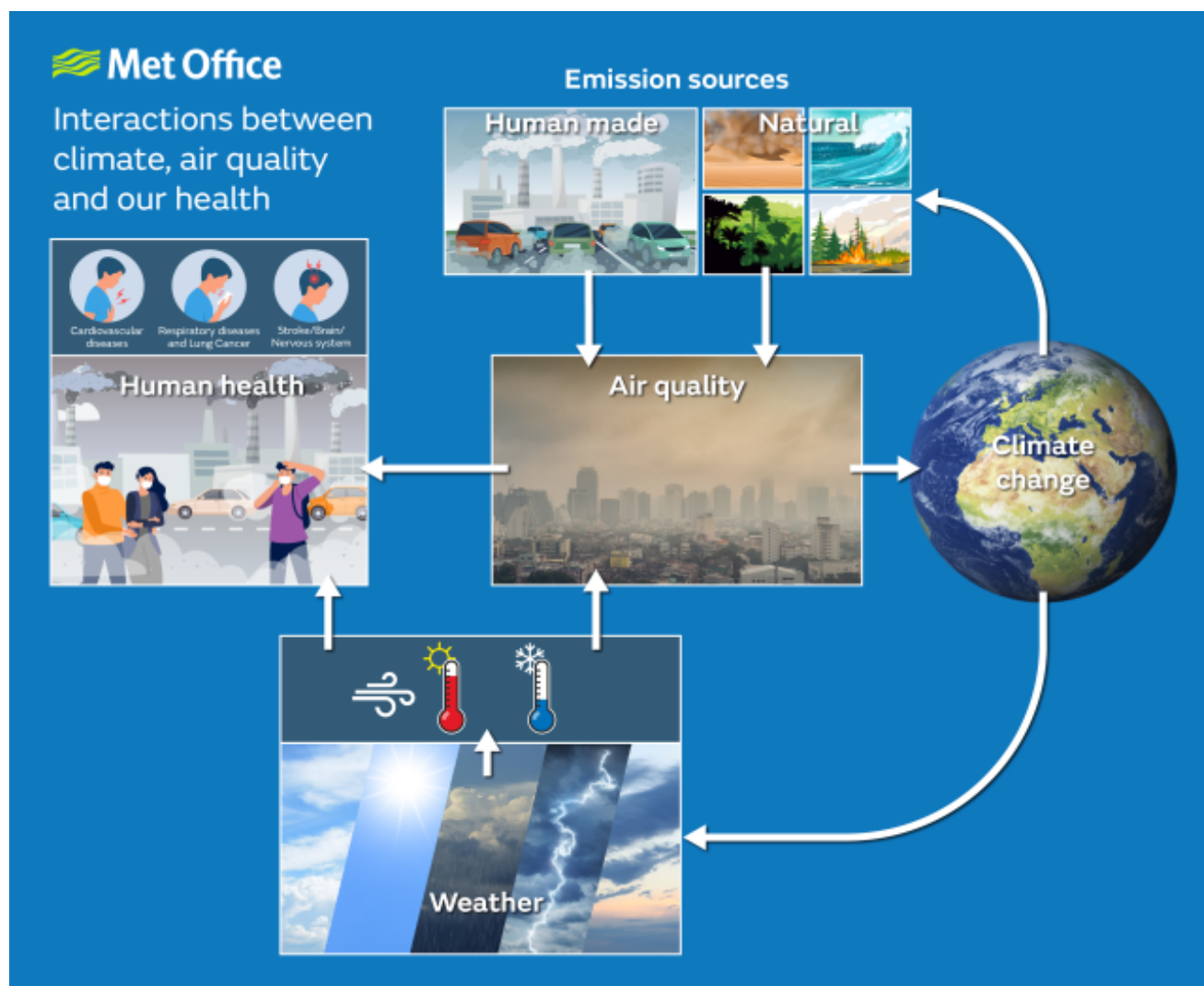
In this latest blog on our January climate theme of health, we explore the links between climate, air quality and our health. This blog has been written by Met Office scientists Steven Turnock, Fiona O'Connor, Paul Agnew and Matthew Hort.

A complicated, interconnected picture

Poor air quality is one of the leading environmental risk factors to human health, with an estimated [4 million annual premature mortalities worldwide](#) and [approximately 30,000 annual premature mortalities in the UK](#) attributed to long-term exposure to outdoor air pollutants. Elevated concentrations of certain pollutants can also lead to other environmental impacts, including poor visibility, reduced crop yields and damage to buildings and vegetation. Poor air quality episodes can cover geographic areas from a single city to larger regions, and normally last from days to weeks.

Certain air pollutants (such as ozone (O₃) and fine particulate matter (PM_{2.5})) are also 'radiatively active', which means they can influence the climate by providing additional warming or cooling. These pollutants are identified as [short-lived climate forcers \(SLCFs\)](#) because they reside in the atmosphere for a short period of time (less than 1 year), meaning their impact on climate is also shorter (within 2 decades) than long-lived greenhouse gases such as carbon-dioxide (CO₂).

Climate change can also [influence the concentrations of air pollutants](#), with [warmer temperatures projected to have detrimental impacts on surface air quality](#) across several regions (e.g., South Asia) in the future. It is also expected to increase the frequency of hot and cold weather events, which may also [adversely impact our health](#). As shown in the graphic below, this leads to a complicated, interconnected picture between health, air quality and climate, where future changes to one can strongly impact the other.



This graphic shows the interactions between air quality, climate and health. Emission sources refer to both human-made (e.g., vehicles, industry) and natural (e.g., desert dust, oceans, vegetation and wildfires) sources that can eventually lead to poor air quality. This has detrimental impacts on human health via a number of routes, including through the heart, lungs and brain. The weather, as well as having its own impact on health, can have a large influence on the severity and length of poor air quality episodes by either trapping pollutants in one place or allowing them to be dispersed in the atmosphere. Climate change is influencing the nature and extent of these weather events and can also change the strength of the natural emission sources. The air pollutants themselves influence the size and rate of the future warming.

What we are doing to better understand the interactions

Within the Met Office, we undertake research on air quality, both at local scales over days to weeks, and at the global scale for periods of decades up to 100 years into the future.

Scientists in the [Met Office Hadley Centre](#) have been working on numerous collaborative initiatives, including the [Climate Science for Service Partnership China](#) (CSSP China) project (supported by the UK Government's Newton Fund), to better understand how climate and air quality interact. A large part

of this work contributes to the [World Climate Research Programme](#)'s 6th phase of the Coupled Model Intercomparison Project ([CMIP6](#)), which seeks to provide a better understanding of the past, present and future climate.

Our scientists have been analysing what the different future climate and air pollutant pathways mean for SLCFs and their impact on both climate and air quality. Our research shows that significant reductions in all air pollutants are beneficial to climate, air quality and human health, whereas there are some negative impacts on air quality and health across regions such as Africa if there are not future reductions in air pollutants. Therefore, it is important to consider the impact on air quality and health from future changes in these SLCFs.

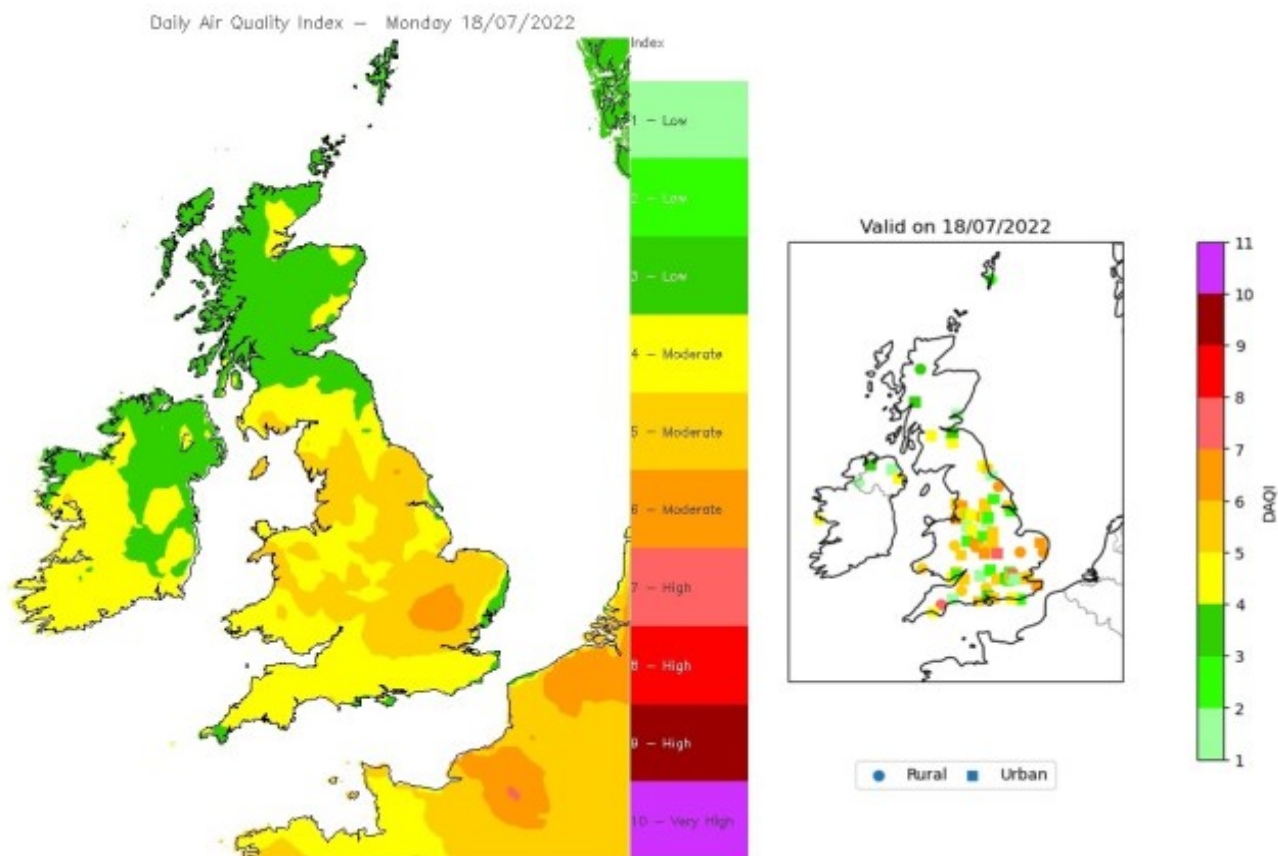
Methane is another important SLCF. It is the [second](#) most important greenhouse gas after carbon-dioxide, albeit shorter lived in the atmosphere, and it contributes to poor air quality globally by forming ozone in the lower atmosphere. Efforts to control atmospheric methane may help to reduce the [near-term future rate of warming](#), along with substantial [reductions in surface ozone](#) – providing clear climate and air quality benefits.

A pledge agreed at the 2021 United Nations Climate Change conference (COP26) to reduce global methane emissions from human activity by 30% from 2020 levels by 2030, has the potential to deliver benefits to climate, air quality and human health. Analysis from the [United Nations Environment Programme](#)'s [Global Methane Assessment](#) suggests that the 30% emissions' reductions could result in 0.3°C of avoided warming over the next two decades.

Corresponding decreases in surface ozone could reduce premature deaths from poor air quality by over a quarter of a million and prevent more than half a million visits to accident and emergency departments from asthma globally every year. Using [new methane modelling capability](#), the Met Office is working with partners in the UK academic community to quantify these outcomes. We will also assess how changes in emissions other than methane may affect the climate, air quality and health impacts.

Our local air quality forecasts

The Met Office produces a 5-day forecast of the [Daily Air Quality Index](#) (DAQI) for the UK. The DAQI is a representation of pollutant concentrations time-averaged throughout the day and gives an indication of overall air quality. The forecast is provided to Defra, as the government department responsible for air quality in the UK, for display on their website, and the data is also used in the Met Office weather app. The air quality forecast is made by combining a computer model for atmospheric chemistry and aerosols with recent observations from the [Automatic Urban and Rural Network](#) (AURN) of air pollution monitors. The observations are also used to check the accuracy of the forecast, as illustrated below.



Maps of forecast Daily Air Quality Index (DAQI) (left panel) compared against observations from the Automatic Urban and Rural Network, AURN (right panel). This figure illustrates the air quality during a period of hot, settled weather in July 2022 which led to elevated levels of the pollutant ozone.

Improving the understanding of air quality and health

The Met Office is involved in several research and development projects to improve our air quality forecast, and to further understand the links between air quality and human health. A core activity is the development of a new modelling framework which will permit an improved forecast resolution.

Another research topic, funded by the [Clean Air Programme](#) and delivered by the Met Office, concerns the production of a UK air quality 're-analysis'. This will use past observations and a modern computer model to provide estimates of hourly pollutant concentrations from 2003 to the present day for the whole of the UK. When compared alongside health records of the UK population, this new dataset has the potential to provide insight and improved understanding of the impacts of poor air quality on human health across different regions and following episodes of elevated pollution levels.

The future of air pollution and health

Poor air quality continues to be an important environmental issue, posing a considerable threat to our health both in the UK and around the world. The future direction of travel, in terms of human-induced emissions, could either worsen or improve this situation and have unintended consequences for climate. The Met Office is at the forefront of research that looks at improving our understanding of the interaction between health, air quality and climate. This will help us to make better predictions of air

quality across a wide range of spatial (local to global) and temporal (days to decades) scales, enabling us to help people make better decisions [to stay safe and thrive](#).

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January 2023